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In teaching the slow learner, little use should be made of reading and book study. These pupils have trouble in defining, distinguishing, analyzing, and memorizing, and are low in achievement, dominance, imagination, and curiosity.

Their activities should be simple, with emphasis on the constructional and manual. Class routine should be strict and work presented in practical situations. Curricular content of mathematics should be related to the role the slow learner will soon play as an adult consumer. Items to be included are budget planning, installment buying, simple machines, electricity, and vocational trades.

A typical suggested course outline for ninth graders is given. Texts and helpful visual aids and procedures are suggested. Individual supervision is useful and drill problems and the contract system of weekly assignments can be used. The units, objectives, and vocabulary of the Retarded Learner (RL) program to be adopted are given. The specific teaching guide for this program lists the activities to be undertaken, the teacher's role in each, and the reason each is included. The appendix contains a list of available films and other teaching aids, and sample drills and tests.

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TENTATIVE CURRICULUM GUIDE

FOR AN RL PROGRAM

MATHEMATICS

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GROSSMONT UNION HIGH SCHOOL DISTRICT

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PREFACE

This study, conducted for the purpose of establishing an RL program in the Grossmont Union High School District, concentrated on three main general areas:

1. identification and understanding of the characteristics of the slow learner

2. discovery and development of available materials and suitable methods

3. development of possible classroom units and evaluation procedures for the RL program

The RL program is designed to meet the specialized needs of the lower ten (10) percent of the student body in the regular high school program. By definition these students will be the lower ten (10) percent, as established by the testing division of the Grossmont Union High School District. They will be failing, or doing poorly, in the areas of English, mathematics, and social studies.

The RL program will be a modified core with the three classes working very closely to develop the student to his maximum ability. The three separate classes will have similar goals and aims. In all cases the educational growth of the individual will be the primary consideration.

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BASIC PHILOSOPHY AND PURPOSE OF THE HIGH SCHOOL

A BRIEF STATEMENT OF THE EDUCATIONAL PROGRAM OF THE GROSSMONT UNION HIGH SCHOOL DISTRICT

The high schools in the Grossmont Union High School District seek to provide an educational opportunity directed toward the optimum development of each student. To this end, programs are established to

1. enable each student to develop his highest potential for a worthy, satisfying and productive life.

2. stimulate and equip him to fulfill his responsibilities as a citizen, that our heritage of freedom may be preserved and extended.

The general objectives of the high school for all youth may be summed up as follows:

1. all youth need to develop in the fundamental skills.

2. all youth need to grow in their ability to think rationally.

3. all youth need to understand the rights and duties of the citizen of a democratic society.

4. all youth need to develop salable skills.

5. all youth need to develop and maintain good health and physical fitness.

6. all youth need to develop respect for other persons.

7. all youth need to understand the significance of the family for the individual and society.

8. all youth need to understand the influence of the science of human life.

9. all youth need wise use of their leisure time.

10. all youth need to know how to purchase and use goods and services intelligently.

11. all youth need an appreciation of literature, art, music, and nature.

12. all youth need to expand their horizons of learning to meet the challenge placed upon them in this era.

A TENTATIVE CURRICULUM GUIDE FOR AN RL PROGRAM

I. Identification and Characteristics of the Slow Learner (RL)[1]

The Slow Learners

The slow learners are geared to slow thinking. They learn at a rate which seems to teachers to be excessively slow. Those with low verbal intelligence have a short attention span for verbal activities. They do not like reading. They are not original in their thinking and they do not see relationships, particularly in the areas that demand use of words or word symbols. When they are confronted with new problems or new situations they need repeated applications before the generalizations can be learned. In any subject taught it is very doubtful that they can accomplish much by simply getting a rule and being expected to apply the rule.

Analysis of Teaching for the Slow Learners

When we analyze our teaching today for the slow learners, we see that much of it depends on books and reading, which of course accentuates the problem. It is equivalent to expecting a pupil to perform as a track star and compete on a team when he has poor coordination and inability to run.

---

1. Composite of remarks by Dr. Leon M. Lessinger, Assistant Superintendent, Curriculum and Guidance

The less reading and book studying slow learners have to do, the better off they are. This means that learning will come best for them in other ways.

Common Errors

One of the common mistakes we have made in the past is to think that slow learners can, by the use of pressure, be made to read faster, study longer, and thus learn more. This is in truth an impossibility. Along with this is the mistaken idea that these pupils will in time catch up and be able to maintain the same level of performance as the average and brighter pupil. These pupils have trouble in defining, distinguishing, analyzing, and memorizing. The low ability pupil may hold some facts that all should know but these cannot be overdone for he is quickly overloaded. These pupils are usually low in achievements, dominance, imagination, and curiosity. They do not think and reason well and are less able to foresee the resolve of some future action.

Special Program

All less capable young citizens need a tailored education designed to make them contributing members of our laboring community. This is a very important concept for all of us to realize. We have called them all kinds of names; "loafer" is a common one. We have the idea that if we keep them in study hall we will make them study, when it is doubtful that they should ever be sent to a study hall. We sometimes do not permit them to go to the library, for in place of studying, they read newspapers and magazines there, when in fact, that is exactly what they should read, not only there, but also in their English classes. They can't help having the equipment they possess. When they mature, they will belong to

the great body of our citizens. These children whose abilities are limited, are slow in learning intellectual things in school. Tomorrow they will do their share of work, cast their votes along with everyone else, and become members of labor unions and other organizations. It is obvious that the standards and ideals they develop are vital to our national welfare.

Level of Expectancy

Boys and girls who do not show an evidence of ability at the end of a given grade should not be promoted, not as regulars, anyway. They should not be permitted to go on until they have developed a proficiency in language and arithmetic that is absolutely required. Now that which is absolutely required must be carefully thought of in terms of their functioning as intelligent citizens. Here are some general principals that grow out of what these pupils need: first of all they need to be taught at a rate of learning that is commensurate with their own tempo of learning. They need remedial reading, they need a general and diversified program. Our programs will need to pay special attention in English and in mathematics. They need enough English for minimum competency. They need enough math to function in family and community life.

Activities for the Slow Learners

The activities designed for these children must be simple, not complex. Plans must be clear and specific. Demonstrations must be given often, and these demonstrations must be followed by an apprenticeship type of learning where the pupil does again that which was demonstrated. Drill and meaningful practice should be regular. The education for these pupils should center on tangible things. Much work should be planned in

constructional and manual activities. This can involve practical arts and music. Teaching should be centered around things that can be seen, heard, touched, tasted, and even smelled. Work should be based on sensory and perceptual levels rather than concept. Reading activities should be cultivated to the point where newspapers, popular magazines, and popular books can be read, understood, and enjoyed. Only when we do these things will we be educating the student of low ability.

Class Routine

School work must be presented in a strict routine with very few, if any, changes throughout the year. School work must be presented in practical situations. Slow learners need school work requiring only short spans of concentrated work. They need assignments that are planned down to the minutest detail, requiring an understanding of these details. They need a great deal of practice drill, drill that they can understand, and drill that is meaningful. They need the help of one teacher rather than to go from teacher to teacher. These are the pupils who do best in a core curriculum, or a team core situation. Research would seem to indicate that not more than 16 pupils should be put in a class. They need a feeling of success in their daily work. They need considerable time in supervised study. They need experience in simple concepts. They need the respect and the feeling of self-enhancement that goes with having gained success. Teachers need to utilize any special abilities which the pupil may possess. They need guidance on how to study. They need vocational information and they need to practice the skills that will allow them to succeed on the job. Everyday these pupils will need attention to such basic needs as the value of daily attendance, punctu-

ality, following directions, getting along with others, and the practice of self-control and truthfulness. They need attention paid to personal cleanliness and the manner of speech.

Discipline

Descipline will be an important part of this program. These pupils must understand that the classroom is no place for meaningless activities, idleness, or disturbing behavior. Students who cannot fit in with such a program should be removed.

Other Traits

In addition to the characteristics of the slow learner already mentioned in the composite of remarks by Dr. Lessinger, some other traits have been shown by research. The N.E.A. Journal presents some interesting additional information in its October, 1959 issue. As the articles state, these characteristics do not apply to all slow learners: there are exceptions to each generality.

The few studies which have been conducted indicate that over one-half of our slow learners are poorer in personal and social adjustment than brighter students. They tend to be rejected by their peers, usually because of their aggresive and unacceptable behavior. They are a "marginal group" which has a self concept which is failure-oriented and which has difficulty in growing up.

Many slow learners are discipline problems in society. This is not surprising since they have difficulty with abstract concepts, including those involving right and wrong and are more frequently apprehended because the home gives them less protection.

While most slow learners (especially boys) react to school failure by aggression, some become withdrawn. This latter group (with girls predominating) cause the schools less trouble but are an even greater challenge. Providing them with sucess experiences and restoring them to better adjustment is a complex assignment. Extreme cases will require psychological and psychiatric attention. But while most slow learners have personality problems, some are amazingly relaxed, pleasant, and well adjusted in spite of repeated school failures.

Teaching Problems

In teaching the slow learner, it is essential to keep mental age (and therefore his corresponding grade capacity) constantly in mind. Research has consistantly demonstrated that mental age is the best single index of capacity for school work.

Even when they work up to capacity, slow learners can only be expected to achieve at between grade 7 to grade 9 levels when they finish high school. Perhaps the biggest single error made in teaching these youngsters is expecting them to work up to their physical age rather than their mental age.

In addition to their slow rate of learning, these pupils forget quickly and have special difficulties with abstract reasoning. They are especially lacking in curiosity, creativity, and critical thinking as these factors apply to school work.

The range of individual differences among all pupils -- including slow learners -- increase with age. Slow learners keep falling further and further behind brighter children as they move into junior and senior high school. Thus, the high school faces an even greater challenge in

in this area than the elementary school.

The slow learner differs only in degree from other pupils. He has the same physical and psychological needs, lives in the same community, and goes to the same schools as other youngsters.

It is in school where he meets his major difficulties. His social and physical adjustment is so near average that he is not recognized as a slow learner until he begins school. Upon graduation he usually loses his labels. He finds his way into unskilled or semiskilled professions, marries, raises a family, and generally carries a reasonable and important share of responsibility as an adult citizen. (6:19-21)

The Slow Learners in Senior High School

The educational career of the slow learners usually end before or immediately after completion of high school. How well they adjust to adult responsibilities will reflect the realism of the school program.

If a high school has small classes and it is possible for the teacher to modify the curriculum and to do individual work, slow learners may be kept in the regular classes.

Most schools, however, have large classes, and this makes grouping of slow learners for required subjects a more feasible approach. Reducing the range of ability enables the teacher to direct his time and energy toward selecting appropriate learning experiences.

Teachers generally agree that the traditional subjects required for graduation present problems in providing realistic school experiences for the slow learners. It is important that courses be offered which will enable him to complete school and that will prepare him to assume adult responsibilities as a family member, a wage earner, and a citizen. Upon

a record of satisfactory achievement and attendance he should be entitled to graduate.

Because of their obvious importance, the areas of English, mathematics, science, and social studies represent a nucleus around which some of the courses could be developed. The exact number of courses required in each of these subject areas would be dependent upon the requirements of the particular school system. Some schools have found that a subject such as social studies can easily be developed into a four year course for the slow learner. The areas of mathematics and science lend themselves to two year courses.

Occupational Information

Slow learners can also be integrated into courses within the regular school to complete a full program. These should be courses which by nature of their content are meaningful and enable slow learners to participate with some degree of success. Examples of such are: driver education, physical education, drama, family living, arts and crafts, typing, and music. Slow learners have much to gain from home economics and industrial arts courses when the content is appropriate to their needs.

A realistic study of occupations applicable to the slow learner would be a desirable part of the curriculum to aid in developing a self-concept for the working world. Topics might be: assessment of individual capacities in relation to job requirements, ways of acquiring and keeping a job, types of jobs available, and information about unions, social security, and insurance.

Teaching Procedures

Slow learners, like all of us, learn most effectively when they become active participants in the learning situation. This can occur only if methods and materials used are within their comprehension. Much emphasis should be given to learning concepts and generalizations in specific concrete situations. Extensive use of films, field trips, exhibits, and group activities might help achieve this end.

Successful teachers of slow learners usually find that group study and short periods of independent study are better for these students than prolonged periods of independent study. They select books and materials which are on the vocabulary and interest level of this group (7:27:28)

. . . .

II. Subject Matter and Procedures Recommended for Teaching Mathematics to Slow Learners

Introduction

The purpose of this chapter is to show the subject matter and sequence of subject matter, and various procedures recommended by research for teaching slow learners in the area of mathematics. A variety of texts have been consulted. Any information available in professional journals and magazines has been gleaned. Manufacturers of teaching machines and visual aids, have provided information. Personnel within the Grossmont Union High School District have provided some proven innovations such as the "contract system."[2]

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2. "Contract system" is simply the process of offering the student a complete set of assignments for a given period of time and allowing the student to work at his own speed so long as he completes the assignments within the designated period of time.

Curricular Content of Mathematics

Curricular content in mathematics might be related to the role the slow learner will soon plan as an adult consumer. It might include work on such items as budget planning and study of installment buying, simple machines, electricity, and vocational trades. There would be need for continued skills and concepts. (6:20)

A typical suggested course outline which would apply to slow learners will be found on the following pages.

NINTH GRADE SPECIAL MATHEMATICS
(First Semester)

This plan for a Ninth Grade Remedial Mathematics Course, generally referred to as, "Special Math," is based on three concepts:

1. Homogeneous grouping is essential in Ninth Grade Mathematics. This results in a "Special" group of pupils who have demonstrated less ability than can normally be expected in Ninth Grade.

2. A realistic appraisal of the pupils involved is necessary in outlining a course for their benefit. These pupils fall generally into two categories:
   a. Those who lack interest.
   b. Those who lack ability.

3. A definite, purposeful plan should be followed in presenting such a course, rather than just using an easier version of the regular General Mathematics Course.

The time units indicated are merely suggestions. Progress in each individual class is considered more important than meeting a time schedule.

1st Six Weeks

A. Whole Numbers - inventory and remedial

Reading and writing whole numbers
Rounding off whole numbers
Addition of whole numbers
Subtraction of whole numbers
Multiplication of whole numbers
Division of whole numbers

B. Fractions

Common fractions
Reduction of fractions
Changing mixed numbers to improper fractions
Changing improper fractions to mixed numbers
Addition of fractions and mixed numbers
Subtraction of fractions and mixed numbers
Multiplication of fractions and mixed numbers
Division of fractions and mixed numbers
Finding what fraction one number is of another
Finding a number when a fraction of it is known

2nd Six Weeks

A. Decimals

Reading and writing decimals
Rounding off decimals
Addition of decimals
Subtraction of decimals
Multiplication of decimals
Division of decimals
Multiplication by powers of 10
Division by powers of 10
Changing common fractions to decimals
Changing decimals to common fractions
Equivalent fractions and decimals

B. Review to date

Remedial work where indicated

3rd Six Weeks

A. Percentage

Meaning of per cent
Changing per cent to decimals
Changing decimals to per cent
Changing common fractions to per cent
Changing per cent to common fractions
Finding a given per cent of a number
Discounts
Commissions
Interest
Finding what per cent one number is of another
Finding a number when a per cent of it is known

SECOND SEMESTER

4th Six Weeks

A. Geometric Constructions

- Definitions
- How to copy an angle
- How to find the midpoint of a line
- How to bisect a segiment
- How to bisect an angle
- How to construct perpendiculars
- How to construct parallel lines
- How to construct geometric figures
  - Squares
  - Rectangles
  - Pentagons
  - Hexagons
  - Octagons
- How to duplicate angles
- How to duplicate triangles

B. Insurance

- Whole life policies
- Paid up policies
- Endowments
- Cash surrender value
- Paid up value
- Term insurance
- Participating policies
- Annuities - immediate and deferred
- Disability waivers
- Double indemnity
- Automobile insurance
  - Public liability
  - Property damage
  - Collision
  - Fire and theft
- House insurance

5th Six Weeks

A. Earning Money

- Part time jobs
- Full time jobs
- Hourly pay
- Overtime
- Withholding tax

Social security
Union dues
Small businesses

A. Borrowing money

Borrowing from banks - rates of interest
Borrowing from finance companies - rates of interest
Borrowing from credit union - rates of interest
Borrowing from pawn brokers - rates of interest
Installment buying - rates of interest

6th Six Weeks

A. Saving money

Bank accounts
    Savings accounts - rates of interest
    Club accounts
    Checking accounts
        How to write checks
        How to balance a check book
        Bank statements
    Other bank activities
Buying U. S. Bonds - payroll savings plans
Postal Savings

B. Spending money

Budgets
Read the label
Buying in quantity
Discounts for cash
Comparing quality

OPTIONAL UNITS

A. Word problems

What does the problem tell you?
What are you to find?
What information do you need?
Does the problem tell you enough?
What information in the problem is essential?
What information in the problem is not important?
What process of arithmetic will you use?
Can you estimate an answer?
Is your answer logical?
Exercises in problems and solutions?

B. Arithmetic in the home

Simple household problems
Reading gas meters
Computing gas bills
Reading electric meters
Computing electric bills
Adjusting receipts
Bill and receipts
Buying for the family

C. Arithmetic in business

Finding profit and loss
Finding per cent of profit and loss
Finding overhead
Buying and selling on commission
Business loans
Basic records (9:5-6)

Another suggestion, using a standard "general mathematics" text designed for 7th and 8th graders and low 9th and 10th graders, would be to adapt it still further for the very slow learners by making certain omissions. These are possible without harm to learning, because the topics omitted will occur in the following year's work or in later courses in general mathematics.

The necessary material to be covered and the omissions possible are given as follows, for the text, Mathematics at Work:

Chapter 1 ... Lines and Whole Numbers
Chapter 2 ... Computing with Whole Numbers
Chapter 3 ... Geometric Forms

(A) Plane Figure
1. Triangle
2. Square
3. Rectangle
4. Trapezoid
5. Circle

(B) Solid
1. Rectangular solid
2. Cube
3. Circular cylinder
4. Prisms
5. Sphere

Chapter 4 ... The use of Fractions
Chapter 5 ... More about Measures
Chapter 6 ... Money and Decimal Fractions
Chapter 7 ... Per cent - A way of Using Certain Fractions
Chapter 10 ... Percents in Use

The slowest pupils should spend most of their time on these chapters. As more able pupils take work in geometry, these slower pupils can do individual study and practice on arithmetic and percentage. (8:9-10)

Teaching Machines

Programed learning in the form of teaching machines or similar devices should be very valuable aids to the problem of teaching math to the slow learners.

As it is known, teaching machines are in a state of infancy with very little concrete information available regarding success or failure.

The Encyclopedia Britannica, developers of the "Temac" teaching machine, were contacted about a program for slow learners. Their brochure, dated January 1, 1962, reported on a program developed for the 7th and 8th grade level, but indicated it was in a testing state. A "Temac" with a detailed program for RL students was ordered on July 2, 1962 for evaluation and eventual placement in the district curriculum library. The cost of this machine is approximately $20.00 per unit. If the testing program is still in process, the RL math classes at El Capitan have been offered as a pilot test group. At the time of the writing of this paper, no reply to this order has been received.

The Encyclopedia Americana, developers of the "Min/Max II" teaching machine, were also contacted. One of these machines was examined and it looked very, very good, but it seemed rather expensive at the quoted $144.00 per unit. However, the company might give a school district a good price on a large quantity purchase. At present no reply has been received to the request for more detailed information.

The Educational Engineering Associates of Torrance, California, distributors of "Speed" teaching machines, have been contacted, but again no reply has been received.

The "Tutor Text" by Courden was considered but it was found that no text in the math area for the slow learner was available. Also, a ditto program learning device from a company in Pasadena was considered, but it was found to be too expensive for the quality of materials.

Because the teaching machines for RL math did not seem to be

available for proper investigation at this time, it was decided that the classes for the coming school year would rely principally upon a conventional text. However, if the machines become available and there is sufficient time to evaluate them, they many be incorporated in the RL mathematics program.

Text Possibilities

After considering several possible texts, including Essential Mathematics, by Lankford, Ulrich, and Clark; General Mathematics, by Brown, Simon, and Snyder; Using Mathematics, by Henderson and Pingry, Mathematics to Use, by Potter; and Mathematics at Work, by Fehr and Schult, the latter was selected as the most outstanding.

Some of the factors in favor of this text for the slow learner in senior high are:

Context

1. The curriculum organization is based on the pupil's needs, interests, and mental maturity as well as on the structure of the subject matter.
2. The materials are presented in an excellent chronological order developing the areas needed to be covered.
3. The manner and order of presenting the material is varied to prevent boredom.
4. The exercises and problems are presented in a wide range of difficulty, from the simplest to the more difficult.
5. The exercises are related to present everyday possible events of the student.
6. Excellent summaries and sample review tests are included in each chapter.
7. The book is easily adaptable to the 7th, 8th or remedial high school program.

Readability

1. The print size is large, making it easy to read.
2. The quantity of print per page is small which aids in reading.
3. Important statements and all numbers are in heavy bold print.
4. An excellent development in vocabulary is presented.
5. The placement of drawings is good.
6. The drawings are easy to read and understand.
7. The book is attractive and pleasant to own and read.
8. There are no identification marks indicating the level of work.

The specific program outlined in the next two chapters of this paper have been planned around this particular text but could be easily adapted to any other good text.

Visual Aids

A wealth of films and film strips that would be particularly helpful to the slow learners and would fit into the material covered in the selected text was found. Many of these are listed as they fit into the various study units in Chapter 4 (Specific Teaching Guide). In addition, the appendix provides a complete list of films, film strips, and free materials.

Procedures

In the area of RL mathematics the following procedures would seem to be applicable:

1. Provide individual supervision and guidance.
2. Use the "Contract System," for weekly assignments.
3. Assign simple drill problems, then relate these to more complex problems.

4. Assist the students in learning vocabulary and reading skills peculiar to mathematics.

5. Emphasize the social uses of mathematics.

In addition, it is well to give individual assistance to pupils after school hours. The slow learners should be encouraged to work at their own rate but all should be required to work in the same general areas. They should have the same homework or "contract" though some may finish their contracts before others. Students who are able should be allowed to complete as many topics within the area currently being studied as their ability will permit.

Instructional adjustments of various kinds should be made for slow-learning pupils. As recommended by the well-known authorities, Grossnickle and Brueckner, some of the most useful procedures are:

1. Make greater use of concrete social experiences to give meanings and to enrich background.

2. Provide more extensive opportunity to manipulate concrete materials in the development of number facts and in demonstration of the meaning of a process.

3. Use more varied visual aids to enable the learner to visualize the situations involved and to grasp the meaning of operations.

4. Be sure to use a well-graded development of new work so that only one new difficulty is introduced at a time.

5. Spread the presentation of successive steps in a new process over a longer interval of time. Do not bunch the development.

6. Allow more time for practice exercises and vary them to avoid monotony of repetition by using interesting devices.

7. Provide a large amount of practice, such as is provided in workbooks. Also more review work is needed.

8. Give considerable guidance of directed reading activities to develop reading skills connected with the use of the textbook and supplementary materials.

9. Delay the introduction of new work until it is clear that the pupil has acquired the underlying skills and concepts essential for its mastery.

10. Make considerable use of manipulative materials and visual aids in the initial presentation of a process to assist the pupil to visualize the method of work.

11. If possible, assign to slow pupils only those activities and problems in textbooks that are not likely to frustrate them.

12. Make use of experience units in which there is a wide variety of activities and see to it that the slow learners are given assignments that are within their interest and at which they are likely to be successful.

13. Check by observation of their work habits and by questioning for evidences of difficulty and lack of comprehension.

14. Give diagnostic tests systematically to locate weak spots at an early stage in learning.

15. Prevent the practicing of errors and faulty procedures by insisting on mastery of each step in the work before others are attempted.

16. Reduce the requirements of the curriculum for slow learners by eliminating the more difficult computational skills, such as addition and subtraction of difficult unlike fractions, and multiplication and division of difficult unlike fractions. (2:464-465)

The last of the above suggestions, namely the simplification of the curriculum, is undoubtedly the most fundamental. Slow learning pupils do not have the mental capacity required to master the more difficult processes with fractions and decimals. If these topics are taught to the slow learning pupils, they should be presented for informational purposes only. However, if the individuals vocational choice requires that he know how to perform these computations, the added mental maturity and the drive to learn, growing out of felt needs, will greatly facilitate learning.

III. Mathematics Program to be Adopted for the Slow Learners for the 1962-63 School Year

Evaluation

Meaning and understanding are the prime requisites in learning numbers. Too frequently, speed and accuracy are the dominant objectives in teaching numbers. Speed and accuracy are both essential, but speed of response should not be stressed until after the pupil has understood a number fact and has been able to use it under varied conditions.

> Many teachers assume that a pupil knows a basic fact if he can give the answer automatically. The ability to make such a response is not an adequate index of the pupil's understanding of the fact. Mastery of a basic fact implies many more things than the ability to give the answer, which may have been learned through repetitive drill. A pupil has mastered a basic fact in addition when he has the following knowledge and abilities:
>
> 1. He can represent the fact with objective materials.
> 2. He knows that addition means putting numbers together.
> 3. He can reproduce the fact promptly and confidently by dramatization, by use of markers, abacus, or on a chalkboard.
> 4. He discovers that interchanging the position of the numbers does not change the sum.
> 5. He knows how to write the fact in both vertical and horizontal forms.
> 6. He can verify the result by use of other known facts.
> 7. He can use the fact in a problem.
> 8. He can give the sum quickly and confidently.
> 9. He can express the sum of a fact totaling 10 or more in its grouped or its ungrouped value.
>
> A similar list may be made to show things which a pupil must be able to do to demonstrate mastery of a fact in subtraction, multiplication, or division of whole numbers, fractions or decimal fractions. (2:232-233)

In addition, a sound knowledge of mathematical vocabulary is essential to the development of skill in reading, speaking of, and using the mathematical material. The word list can be used in several ways:

(a) For learning correct spelling and pronunciation of words.

(b) For defining, describing, and illustrating the meaning of each word.

(c) For using the words correctly in a sentence.

(d) For locating the place in the textbook where the words are first introduced and given their mathematical meaning.

It is the responsibility of the mathematics program for the slow learner to work toward a mastery of the four fundamental operations. These are addition, subtraction, multiplication, and division of whole numbers, fractions, and decimals, together with an understanding of how to use these operations in solving actual problems. The more closely the learning of arithmetic is integrated with its uses in the affairs of daily life, the more productive the experiences will be (2:5). Therefore, "to improve the holding power of the high school, it is necessary to demonstrate to many pupils (especially slow learners) that there is a worthwhile relationship between what is being taught and the activities of daily living in the community." (10:111)

With this in mind and the general characteristics of the "slow learner" already stated in this report, this course of study has been developed. Let us remember that these students have very short attention span and that activities for them must be simple. Plans must be clear and specific. Demonstrations must be given often. These slow learners will also demonstrate a need for security and success in their school life. Therefore, a strict routine of classroom procedure with few, if any, changes made throughout the school year should be maintained. All these should be kept in mind as units in the following areas are developed:

First unit

Measurement

A. Lines and Angles
   1. Straight Lines
   2. Point or Points
   3. Naming Lines
   4. Line Segments
   5. Measuring Line Segments
   6. Linear Measure
   7. Pair of Lines

B. Angles
   1. Ray
   2. Kind of Angles
   3. Measurement of Angles
   4. The Protractor
   5. Vocabulary to accompany unit

Second Unit

Whole Numbers

1. Understanding our System of Counting
   (a) Historical development
   (b) Counting systems of other cultures
2. Reading and writing whole numbers
3. Addition of whole numbers
4. Subtraction of whole numbers
5. Multiplication of whole numbers
6. Division of whole numbers
7. Division and multiplication of whole numbers by tens.
8. Vocabulary

Third Unit

Fractions

1. Measuring of fractions
2. Comparing fractions
3. Adding like and unlike fractions
4. Compare sizes of fractions
5. Subtracting like and unlike fractions
6. Adding and subtracting mixed fractions
7. Multiplying a fraction by a
   (a) Whole number
   (b) Fraction
   (c) Mixed number
   (d) Division of fractions and mixed numbers
8. Vocabulary

Fourth Unit

Measurement

- A. Linear measure
- B. Weight measure, dry measure
- C. Liquid measure
- D. Time measure
- E. Measure of temperature
- F. Vocabulary

Fifth Unit

Money and Decimal Fractions

- A. Understanding decimal fractions
  - 1. Reading
  - 2. Writing
- B. Adding and subtracting amounts of money
- C. Adding decimal fractions
- D. Subtracting decimal fractions
- E. Multiplying decimal fractions
- F. Division of decimal fractions
- G. Rounding off the answers
- H. Vocabulary

Per cent

- A. What per cent means
- B. Per cent as decimal fractions
- C. Simple multiplication using per cents

Sixth Unit

Geometric Figures

- A. Simple geometric figures. Identification of each.
- B. Perimeters
- C. Circumference of a circle
- D. Areas
  - 1. Square
  - 2. Rectangle
  - 3. Circle
  - 4. Triangle
- E. Surface areas of
  - 1. Cube
  - 2. Rectangular solid
  - 3. Cylinder
- F. Volumes
  - 1. Cube
  - 2. Rectangle
  - 3. Cylinder
  - 4. Cone
  - 5. Pyramid

Schedules

A simple but adequate schedule of events each week is necessary. The following suggested weekly schedule should be helpful.

Monday - Collection of past week's contract.
Give out new contract.
Introduce new skills to be learned for that week, lecture, films, filmstrips, etc.
Supervised study.

Tuesday -Short quiz.
Pass back last week's contract.
Teach first skill of the week again.
Supervised study.

Wednesday - Short quiz.
Review first skill.
Teach second skill for the week.
Supervised study.

Thursday - Review first and second skills.
Short vocabulary test.
Teach by supervised study.

Friday - Short weekly quiz.
Supervised study to finish contracts.

A daily schedule might be comprised of the following:

1. Short five (5) question quiz.
2. Correction of this quiz.
3. Introduction and teaching of the skill to be learned by lecture, demonstration, student demonstration, film, filmstrip, etc.
4. Short use of teaching machine by those who still need it and working on weekly contract for those who can.

Aids

More specific information for presenting these suggested units include a spelling and vocabulary list, a record of assignments sheet, and specific assignments from the selected test, Mathematics at Work, by Fehr and Schult. These items follow

Vocabulary

MEASUREMENT	WHOLE NUMBERS	FRACTIONS	DECIMALS AND PER CENTS
measure	add	fraction	decimal fraction
linear	addition	denominator	per cent
linear measure	additive	numerator	percentage
linear inch	sum	common denominator	base
linear foot	plus	simple fraction	rate
linear yard	increase	proper fraction	time
linear mile	decrease	improper fraction	part
foot	less than	mixed number	whole
inch	difference	common fraction	principle
yard	minus	equivalent fraction	time
rod	subtract	unlike fraction	commission
mile	subtraction	common factor	discount
perimeter	multiple	concellation	overhead
area	multiplier	reduce	profit
volume	product	invert	loss
capacity	divide		interest
square	division		sales price
square inch	quotient		reduced price
square foot	reduce		decrease
square yard	vertical		margin
square mile	horizontal		
cube	equal		
cubic	average		
cubic inch	remainder		
cubic foot	exceed		
cubic yard			
cubic mile			
rectangle			
rectangular			
circle			
diameter			
radius			
circumference			
pint			
quart			
gallon			
bushel			
ounce			
pound			
ton			
second			
minute			
hour			
day			
week			
month			
year			
decade			
century			
prisms			
cylinder			

RECORD OF ASSIGNMENTS

First Semester

Name _____

Subject _____

WEEK	ASSIGNMENTS				WEEKLY TEST AVERAGE	WEEKLY AVERAGE GRADE
	1	2	3	4		
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						

Additional Remarks: _____

RECORD OF ASSIGNMENTS

Second Semester

Name _____

Subject _____

WEEK	ASSIGNMENTS 1	2	3	4	WEEKLY TEST AVERAGE	WEEKLY AVERAGE GRADE
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						

Additional Remarks: _____

_____

_____

CONTRACTS

First week
1. p2 Do problems 1-8
2. p6 " " 1-14
3. p8 " " 1-4
4. p11 " " 1-10

Second week
5. p11 Do problems 11-21
6. p12 " " 2,4,7
7. p17 " " 1-6
8. p 17 " " 7-12

Third week
9. p19 Do problems 1-4
10. p20 " " 5-7
11. p22 " " 1-7
12. p22 " " 8-11

Fourth week
13. p25 Do problems 1-3
14. p25 " " 4-7
15. p26 " " 1-6
16. p28 " " 1-12

Fifth week
17. p29 Do problems 1-5
18. p30 " " 1-11
19. p31 " " 1-5
20. p31 " " 6-10

Sixth week
21. p34,35 Do problems 1-10
22. p35,36 " " 11-16
23. p36,37 " " 17-21
24. p37 " " 22-25

Seventh week
25. p48 Do problems 1-40
26. p49 " " 1-13
28. p50 " " 1-5
29. p51 " " 1-10

Eighth week
30. p53 Do problems 1-40
31. p54 " " 1-12
32. p55 " " 1-30
33. p56 " " 1-10
34. p57 " " 1-7

Ninth week
35. p58 Do problems 1-30
36. p59 " " 1-9
37. p60 " " 1-30
38. p61 " " 1-12

Tenth week
39. p63 Do problems 1-24
40. p65 " " 10-18
41. p66 " " 1-12
42. p68 " " 1-7

Eleventh week
43. p68 Do short test problems 1-9
44. p71 Do problems 1-6
45. p72 " " 1-5
46. p72,73 Do problems 6-11

Twelfth week
47. p75 Do problems 1-11
48. p75,76 Do problems 12-24
49. p76 Do problems 25-30
50. p76 " " 31-37

Thirteenth week
51. p108 Do problems 2-7
52. p108,109 Do problems 8-12
53. p110 Do problems 1-6
54. p111 " " 1-25

Fourteenth week
55. p112 Do problems 4-12
56. p113 " " 2-16
57. p113 " " 18-25
58. p113 " " 26-37

Fifteenth week
59. p114 Do problems 2-12
60. p115 " " 13-22
61. p116 " " 2,5,6-8
64. p116 " " 9-13

Sixteenth week
65. p116 Do problems 1-12
66. p117 " " 13-22
67. p140 " " 15-24
68. p140 " " 25-34

Seventeenth week
69. p118 Do problems 1-10
70. p119 " " 1-10(top)
71. p119 " " 1-14
72. p119 " " 15-25

Eighteenth week
73. p120 Do problems 1-7
74. p120,121 Do problems 8-12
75. Semester test
76. Semester test

Nineteenth week
77. p122 Do problems 1-13
78. p123 " " 15-20
79. p123 " " 21-28
80. p123 " " 29-35

Twentieth week
81. p124 Do problems 2-10
82. p124 " " 11-20
83. p125 " " 21-31
84. p125 " " 32-43

Twenty-first week
85. p126 Do problems 1,2,3,4,15
86. p127 " " 1-18
87. p128 " " 1-11
88. p128 " " 12-19

Twenty-second week
89. p130 Do problems 4-12
90. p133 " " 7-20
91. p133 " " 21-33
92. p135 " " 14-25

Twenty-third week
93. p145 Do problems 6-15
94. p146 " " 1-6
95. p147 " " 7-12
96. p147 " " 13-19

Twenty-fourth week
97. p148 Do problems 1-5
98. p149 " " 6-16
99. p150 " " 1-8
100. p153 " " 5-20

Twenty-fifth week
101. p154 Do problems 1-8
102. p155 " " 9-14
103. p155 " " 15-20
104. p156 " " 1-7

Twenty-sixth week
105. p166 Do problems 1-16
106. p167 " " 17-25
107. p196 " " 12-15
108. p174 " " 1-12

Twenty-seventh week
109. p178 Do problems 1-9
110. p179 " " 4-15
111. p180 " " 1-20
112. p182 " " 5-10

Twenty-eighth week
113. p182 Do problems 11-16
114. p183 Even problems only 10-36
115. p186 Do problems 1-12
116. p186 " " 19-30

Twenty-ninth week
117. p190 Do problems 1-10
118. p190 " " 16-26
119. p194 " " 1-2
120. p196 " " 16-25

Thirtieth week
121. p205 Do problems 12-31
122. p205 " " 32-51
123. p209 " " 1-16
124. p211 " " 1-6

Thirty-first week
125. p213 Do problems 3-5
126. p216 " " 23-42
127. p218 " " 1,3,4
128. p219 " " 15-25

Thirty-second week
129. p229 Do problems 1,2
130. p230 " " 4-7
131. p240 " " 1-4
132. p244 " " 1-3

Thirty-third week

133.	p272	Do problems	1-12
134.	p343	" "	1-6
135.	p274	" "	1-4
136.	p282	" "	5,16,17,18,19,21,22,24

Thirty-fourth week

137.	p278	Do problems	1-11
138.	p278	" "	12-17
139.	p281	" "	27+Teacher made ditto sheet
	p283	" "	16
140.	p283	" "	13-15+Teacher made ditto sheet

Thirty-fifth week

141.	p256	Do problems	1-6
142.	p258	" "	1-3,
	p259	" "	1-5
143.	p260	" "	1-11
144.	p265	" "	24-41

Thirty-sixth week

145. Review
146. Review
147. Semester test
148. Semester test

IV. Specific Teaching Guide for the Slow Learner's Mathematics Program for the 1962-63 School Year

Objectives

This teaching guide has been designed in an attempt to fulfill the following objectives:

1. The basic principle of the public secondary school, that the school must serve equally well all the educatable youths in the community.

2. To develop and increase the mastery of computational techniques and skills.

3. To contribute to the individual's vocational competence, consumer effectiveness, successful family life, and community membership.

4. To develop an understanding of mathematical relationships.

5. To develop habits of organization, neatness, responsibility and initiative so needed in all occupations.

6. To develop an adequate mathematical vocabulary.

7. To develop interest, self-confidence, and desirable attitudes in mathematics.

8. To develop wide experience in mathematical situations.

9. To develop logical methods of problem solving.

10. To contribute to the general education of the student.

11. To contribute to the general holding power of the high school.[3]

ACTIVITY

1. Introduce the concept of measurement

2. Accuracy in measurement

3. Measuring line segments (whole units)

---

3. The above objectives are a composite of objectives found in the following:

1. Hamilton County Mathematics Guide, Cincinnati, Ohio, 1956.
2. Principles of Secondary Education, Harcourt, Brace and Co., New York, 1958.
3. Math in the Junior High, Berkely Unified School District, 1954.
4. General Math Guide 1., Los Angeles City Schools, 1951.
5. Guide to Teaching Math., Minneapolis Public Schools, 1955.
6. The Teaching of Math in Illinois, U. of Ill. Study Group on Math, 1957.
7. Some Basic Math Concepts, Sch. Math Group, Yale University, 1956.

TEACHER'S ROLE	REASON
1. Introduce by a teacher-led discussion involving the various techniques of measurements that we might use everyday. The teacher should develop the following general areas. (a) Quantity - adding machines, street numbers, automobile license, etc. (b) Length - ruler, yardsticks, tape measures, etc. (c) Time - clock, calender, sun dials, metronome. (d) Value - coins, bills, checks, stamps, tokens, etc. (e) Weight - truck scales, bathroom scales, postal scales, etc. (f) Area - square inchs, carpet sizes, house plans, etc. (g) Volume - pints, quarts, gallons, cubic inches, etc. (h) Temperature - thermometer, automobile temperatures, gauges.	1. To motivate the idea and importance of measurement in everyday uses.
2. Develop the concept and answer the question "Why be accurate in your measurement?" Use the following examples to illustrate what happens if the measurements are not accurate: (a) A project in woodshop. (b) A project in machine shop. (c) Historical development of the automobile engine. (d) Medical prescriptions. (e) Cooking. (f) Possibly use a "Primitive Pete" Flintstone story to show the cultural development of needs for accurate measurements.	2. To develop an appreciation of accuracy in measurements.
3. (a) Teach the technique of measuring a line segment by using the following aids: (1) A one-foot rule. (2) A yard stick. (3) A three-foot folding rule. (4) An eight-foot or ten-foot steel tape. (5) A meter stick. (b) Teach the relationship of various units of length, comparing an inch to a foot, foot to a yard, etc., by using the following aids: (1) Cut tape to various lengths and paste to the bulletin board. (Identify each) (2) Cut pieces of wood to various exact lengths for each student to measure. (3) Road distances from city to city on a map.	3. (a) To teach the importance of measurement in our modern world. (b) To give the first experience in linear measure. (c) To teach the identification and use of the simple tools of measurement. (d) To give application of various measurements of line segments in real concrete situations.

ACTIVITY	TEACHER'S ROLE	REASON
4. Measurement (Fractional units)	4. Introduce the concept of fractions and the reasons why we need fractions in our complex world: (a) Do this by telling a story about "Primitive Pete" and his need for fractions. (b) Give concrete visual examples of the use of fractions. (c) Teach how the common tools of measure are fractionally divided. (d) Teach the relationship of sizes of fractions. (e) Have students actually measure items in the classroom.	4. (a) To show why we have fraction and that fractions are something other than "pies." (b) To show the social implications of fractions. (c) To give experiences using common tools of measuring and experience the actual measurement.
5. Measurement using (Decimal fraction)	5. Re-teach why we have decimals and the social implication of decimal fraction. (a) Use money examples. (b) Bring a group of micrometers (borrowed from machine shop) to class. Teach the use of the micrometer. (1) 40 threads per inch, therefore, the spindle will move .025 of an inch per revolution of the barrel. (2) Have student measure a few sample pieces of metal. (3) Have each student measure a hair from their head and write down the result. (an average hair is .0025 inch in diameter)	5. (a) To teach the use of decimal fractions in our society. (b) Experience actual use of measuring tools.
5. Linear measure	6. Teach the term linear measure and its uses. (a) Running foot	6. To teach the use of common mathematics terms.
7. More about measures.	7. Because of the social implication you should teach more about measures that are common to the student such as: (a) Weights. (b) Dry measure. (c) Liquid measure. (d) Time measure. (e) Temperature. (f) Stopping distance of a car for any speed Miles per hour x 5280' = feet/hour feet/hour x 3600 sec/hr = feet/sec. feet/sec. x normal reaction time is equal to the stopping distance.	7. To implant the ideas and the social application of measures and the art of accurate measurement to the students everyday surroundings.

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TEACHER'S ROLE	REASON
Suggested films to accompany the unit 1. Measurement (10 min.) 2. Indirect Measurement (12 min.) 3. The Micrometer (15 min.)	Location: San Diego County University of Calif. University of Calif.
Suggested filmstrips to accompany the unit 1. How Long Is It? 2. Linear Measure (Part 1)	San Diego County San Diego County
Related films Principles of Scale Drawing	San Diego County
Related filmstrips 1. Measuring, Testing, and Marking Tools for Woodworking (Set of 8) 2. Special Measurement.	San Diego County San Diego County
Free Bulletins or Pamphlets 1. Ford Motor Company, Educational Relations, Informational Service, Dearborn, Michigan 2. Lufkin Rule Company, Saginau, Michigan	
8. Introduce and show real examples of the various common angles. (a) Straight angle. (b) Acute angle. (c) Right angle. (d) Obtuse angle.	8.(a) To increase the understanding of our geometric angles. (b) Increase the student's vocabulary.
9. Teach the use of a protractor. (a) Make true angles on the chalkboard and measure these by use of the chalkboard protractor.	9.(a) To teach the use of the protractor and how to measure angles.
Suggested films relating to this unit Lines and Angles (10 min.) Parallel lines (10 min.)	San Diego County San Diego County
Suggested filmstrips relating to this unit Lines and Angles Surface Measures (Part 3)	San Diego County
In the study of angles, be sure to: 1. Help pupils learn all the new words. 2. Point out that an angle is a figure rather than an "amount of turning." 3. Tell them the importance of knowing how to read and letter angles correctly. 4. Point out the fact that the drawings in any book are only illustrations of angles.	

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Y	TEACHER'S ROLE	REASON
	Although the material is not new, the emphasis on meaning will be new to some pupils. Here, the stress will be on thinking and the need for knowing why the operations are performed the way they are.	
duce	1. Introduce the concept of whole numbers using a "Primitive Pete or Flintstone" story about their needs for a basic numbering and counting system. Bear this in mind that the complexity of a culture goes hand in hand with its numbering system.	1. To give an understanding of why we need to study mathematics and why it is so important to thoroughly understand basic numbers.
rs	2. Show how counting in other languages or cultures compares to our own numbering system. Use the idea of: (a) The nature of our ten-system. (b) The idea of place value.	2.(a) Motivation in the basic understanding of our numbering system. (b) To let any student knowing a foreign language show the association of the two systems.
ing ns	Suggested films to accompany the unit 1. The Earliest Numbers (30 min.) 2. Origin of Mathematics (10 min.) 3. Donald in Math Magicland (26 min.) 4. Story of Our Number System (11 min.) 5. Understanding Numbers "Program 1" (30 min.)	University Exten. University Exten. District Film San Diego County District
	Suggested filmstrips to accompany the unit 1. Understanding Hundreds, Tens, and Ones 2. Number Stories of 7 and 8 3. Number Stories of 9 and 10 4. Number Stories of 11 and 12 5. Number Stories of 13 to 18 6. Recognizing Numbers 7. Getting Acquainted With Numbers 8. How Many	San Diego County " " " " " " " " " " " " " "
	Pamphlets - References to accompany the unit 1. Number Stories of Long Ago 2. Numbers and Numerals	National Council of Teachers

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CTIVITY	TEACHER'S ROLE	REASON
	The basic fact in addition consists of all possible arrangements of two, one place numbers from 1 to 9 inclusive.	
Introduce addition	3. Briefly discuss the need for addition designed around the idea of "grouping items" sequence. (a) Begin with a problem which has social significance to the student. (b) Have the class discover various ways to fihd the answer. (c) Have a pupil make a verbal statement of the process and also his symbolic representation that he used to arrive at his answer. (d) Have the class study the development of this process given in the text.	3.(a) To review addition and to develop a concrete understanding of the addition process. (b) To give this process social significance.
Teach the Vocabulary	4. Teach the words needed to accomplish this arithmetic skill such as: (a) Add (b) Sum (c) Plus (d) Addition	4.(a) To teach the mathematics vocabulary. (b) To contribute to the student's general education.
Teach the commutative law of addition	5. Teach the fact that order of numbers in addition does not change the sum.	5. To teach a further concept in understanding basic addition.
Teach actual one column addition	6. Teach the one column addition of numbers from 1 through 9.	6.(a) Reviewing a basic concept. (b) Building a good concrete foundation.
Teach horizontal one column addition	7. Give practice and drill in horizontal addition as well as vertical addition.	7. Teaching techniques of the business world.
Mastery of the skill	8. Attain a level of mastery of the process through usage and practice (2:256-257)	
Introduce addition of multiple columns	9. Illustrate the idea of grouping of tens. Demonstrate and illustrate this procedure when there are two or more columns of numbers. Add each column from right to left. If the sum of any column is ten or more, write the last figure of the sum in the answer and carry the tens figure to the next column. (a) Demonstrate this concept by a grocery store receipt, gasoline credit card bill, or any similar device.	9. Review basic facts of the arithmetic skills. (a) The teaching of the addition process

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ITY	TEACHER'S ROLE	REASON
	(b) A teacher might introduce the Trachtenberg Speed System of Basic Mathematics for addition which seems to interest this student. Filmstrip to accompany this unit Column Addition (30 Fr)	(b) As a motivation device San Diego County
ch gle umn traction	10. Teach the concept of the difference between two numbers differing by less than ten. (a) The concept that subtraction is just the opposite of addition should be discussed. (b) A teacher must be careful in his examples. He must remember that he is talking to high school students and his examples must be on this level. Vocabulary minus, decreased, down, less than, lose, take away, use up. Suggested film to accompany this unit: Adding and Subtraction (10 min.)	10. Review of basic arithmetic skills. (b) The teaching of the subtraction process San Diego County
	The three methods of subtraction most commonly used in compound subtraction are as follows: 1. Additive method 2. Decomposition method 3. Equal-additions method For the slow learner it is suggested to use the decomposition method $\begin{array}{r} 65 \\ -37 \\ \hline \end{array}$ or $\begin{array}{r} 5\,15 \\ \cancel{6}\cancel{5} \\ -37 \\ \hline 28 \end{array}$	
ch ound umn raction	11. About the same sequence of steps used for presenting carrying in addition applies to compound subtraction. (a) Review this process by real examples. (b) Teach how to check a subtraction problem. Filmstrip to accompany this unit 1. Subtract To Find Out (30 Fr.) 2. Adding and Subtracting Two place numbers (30 Fr.)	11. To teach the basic arithmetic skill of compound subtraction. San Diego County San Diego County
oduce ipli- on	12.(a) Help pupils see that multiplication of whole numbers is a short process of addition. (b) Teach commutative law for multiplication 2 x 3 = 3x2 (c) Develop a complete understanding of the multiplication table through 12's by using flash cards, drill, and real concrete examples of this multiplication process	12. To develop an insight and a skill in the process of multiplication

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IVITY	TEACHER'S ROLE	REASON
	(d) Teach the following ideas: 1. Multiplication by the number one gives the number itself. 2. Multiplication by zero gives zero as the product. 3. Multiplication by an even number gives an even number. 4. When a number is multiplied by 5, the product always ends in 5 or 0. 5. When a number is multiplied by 3, the sum of the digits in the product is divisible by 3. 6. When a number is multiplied by 9, the sum of the digits in the product is 9.	
Multipli-cation of single columns.	13. Give and show the reasons for multiplication. 1. Short method for counting. 2. Short method for adding. (a) Give drill on this process using examples from real student situations.	13. To teach the process of single column multiplication
Multiplying by 10,100 and 1,000	14. Teach and prove that to multiply a whole number by 10, place a zero to the right of its numeral, to multiply a whole number by 100, place two zeros to the right of the numeral, etc. (a) Drill will be centered around a form of program learning, contracts, and flash cards.	14. To teach a quick and accurate method of multiplying by 10,100 and 1,000.
Multipli-cation of number of several digits.	15. Present this material by many examples on the chalk-board using various combinations of numbers. (a) Develop the idea of carrying ten units as we did in the addition units. (b) There should be many questions on the daily tests using multi-columns of multiplication. (c) Introduce Trachtenberg Speed System of Basic Mathematics for the teen numbers only. (d) Depend upon repetition to fixate the process. (e) Teach vocabulary that accompanies this basic skill. (f) Teach the process of checking a multiplication problems by 9's.	15. To present the basic skills of multiplying multi-column figures.
	Possible related film to accompany this unit: ABC of Hand Tools (42 min.) (Introduction to vocational series)	San Diego County
Introduce division of the place numbers and the place divisors.	16. Division is the inverse of multiplication. (a) Division has two different meanings: first how many times one number is as large as another; a second, the size of the equal parts into which a number is divided.	16. To develop complet understanding of the arithmetic process of division and in-crease their skill in using it.

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	TEACHER'S ROLE	REASON
	(b) Meaning is developed by experiencing varied illustrations of the process with manipulative materials. (c) Start with all even division facts and gradually work toward the uneven division facts and the remainder fact. (d) Sample test questions could be as follow: 1. 2844 ÷ 3 — 6. 5785 ÷ 8 2. 7826 ÷ 5 — 7. 7589 ÷ 9 3. 1714 ÷ 2 — 8. 27822 ÷ 4 4. 45663 ÷ 7 — 9. 2761 ÷ 6 5. 1546 ÷ 4 — 10. 8389 ÷ 9 (e) Teach how to check a division problem, since no arithmetic problem is complete until it has been checked. (f) For general information you might teach the process of checking by 9's. (g) Attain a level of mastery of the process through usage and practice. (2:256-257)	
ion of r with al s	17. Teach long division by examples and drill and more usage. (a) Show real concrete evidence as to the reason for division. (b) A suggested sequence for teaching the steps of division of several digits is as follows: 1. Dividing by tens or multiples of 10 (60 ÷ 20) 2. Dividing by other two place numbers when the estimated quotient is the true quotient (63 ÷ 21) 3. Dividing by two place numbers when the estimated quotient is not the true quotient (80 ÷ 21) (c) Teach the form of writing long division. (d) Teach relationship between multiplication and division and how to check the answer. (e) Teach the vocabulary that accompanies this arithmetic skill	17. To teach the basic fundamental arithmetic skill of division of whole numbers.

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TIVITY	TEACHER'S ROLE	REASON
	Fractions are to be reviewed thoroughly to allow the students to become adept in their use. Fractions are a common problem area for students and adults. For this reason they are to be covered quite thoroughly even though the subject matter may be repetitious.	
Introduce fractions	1. Develop a concrete understanding of the meaning of a fraction, why we have fractions, what good are they, etc. (a) You might use another "Primitive Pete or Flintstone" character type story to develop the cultural need for fractions. (b) Be sure to use examples that are real to the students. (c) Use any visual aid possible to teach the true meaning of fractions. (d) Remember the social application of fractions as Breslich states in his book, The Administration of Mathematics in the Secondary School, page 203, "that 99 per cent of the fractions used have denominator of 2, 3, 4, 5, 6, 10, 12, and 16." It is felt that fractions with denominators of 32, 64, 100 would bring this study up to the present day needs. With this in mind we should develop problems, classroom discussions, and tests of evaluation using these common denominators. By doing this we make the fractions have social significance rather than a pure mechanical process. (e) Remember that a fraction should not always be demonstrated by a circle or a pie, use other aids such as rulers, measuring cups, etc. (f) Remember that rules of the thumbs can sometimes confuse this student, such as the larger the denominator the smaller the fraction, but only if the numerator remains the same. This student forgets the last phase. (g) Teach the vocabulary that accompanies this unit.	1. To develop and introduce fractions and to establish a real understanding of the meaning of fractions.
	Suggested filmstrip relating to the unit. The Meaning of Fractions (43 Fr.)	School Math Library
	Suggested films relating to the unit. Introduction to Fractions (10 min.) Fractions (30 min.)	U. of California U. of California
Changing fractions to equivalent fractions.	2. Teach how to raise or reduce a fraction by multiplication or division of the numerator and denominator by the same value. Show that two quarters ($\frac{1}{4}$ of a dollar) is equal to one half dollar ($\frac{1}{2}$ of one dollar) Teach the concept of like fractions.	2. To develop in the student an understanding of relationships of fractions.

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ACTIVITY	TEACHER'S ROLE	REASON
	(a) Teach the difference between an improper fraction and a mixed number. (b) Throughout this unit be sure to teach the relationships in sizes of fractions.	(a) To develop a skill in finding a fractions' equivalent.
3. Like and unlike fractions, improper and mixed fractions	3. Teach the difference of like and unlike fractions, and how to make these fractions all like fractions. (a) From the study of the method of changing improper fractions to whole numbers or mixed numbers, the class should make the following generalizations. 1. When the numerator is equal to or greater than the denominator, the fraction may be changed to a whole number or a mixed number. 2. An improper fraction is changed to a whole number or a mixed number by dividing the numerator by the denominator. 3. The integer found in the quotient when dividing the numerator of an improper fraction by the denominator represents the number of wholes and the remainder, if any, is the fractional part of a whole remaining.	3. To establish the difference between like and unlike fractions. (b) To teach the process of changing a mixed number to an improper fraction.
	Suggested filmstrip relating to the unit Changing the Terms of a Fraction (48 Fr.)	School Math Library
. Adding like fractions and mixed numbers.	4. Like fractions, that is, those having the same denominator, can be added at once, but unlike fractions must be changed to like fractions before they can be added. (a) Give the student practice in adding very simple like fraction types, including examples in which the sums are reducible, we can make the following generalizations about the process. 1. Fractions must have the same denominator before they can be added. 2. The numerator of the fraction in the answer is equal to the sum of the numerators in the example. 3. The denominators of the fraction in the answer is the same as the denominator of the fractions. 4. All sums should be expressed in lowest terms.	4. To teach the arithmetic process of adding like and mixed numbers.
	Suggested filmstrips related to the unit Adding Like Fractions and Mixed Numbers (35 Fr.)	School Math Library
. Adding unlike fractions and mixed numbers	5. Teach the reason why before adding unlike fractions you must raise or lower the fractions so that the fractions to be added will be like fractions (because only like units may be added).	5. To teach the arithmetic skill of adding unlike fractions and mixed numbers.

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ACTIVITY	TEACHER'S ROLE	REASON
	(b) The two acceptable basic methods of finding the LCD are: 1. The product of the denominators, as in the example 1/2 + 1/3. 2. The product of factors of the denominators, as in the example, 1/6 + 1/8. Suggested films relating to the unit How to Add Fractions How to Change Fractions Suggested filmstrip relating to the unit Adding Unlike Fractions and Mixed Numbers (35 Fr.)	 San Diego County San Diego County School Math Library
6. Subtracting of like fractions and like mixed numbers	6. The generalizations discovered in addition of like fractions are similar for the subtraction of like fractions. They are as follows: 1. Fractions must have the same denominator before they can be subtracted. 2. The numerator of the fraction in the answer is equal to the difference of the numerators in the example. 3. The denominators of the fraction in the answer is the same as the denominators of the fraction. 4. All differences should be expressed in lowest terms. The pupil who can add the fractions 1/3 and 1/3 finds little or no difficulty in working the related subtraction example 2/3 - 1/3. Emphasize the area of subtracting a fraction from a whole number. Do not use the word "borrowing" Suggested film relating to the unit How to Subtract Fraction (10 min.) Suggested filmstrip relating to the unit Subtracting Like Fractions and Mixed Numbers (33 Fr.)	6. Teach the arithmetic skills and social relationships of subtracting like fraction and like mixed numbers. San Diego County School Math Library
7. Subtraction of unlike fraction and mixed numbers.	7. The subtraction of unlike fraction is very similar to that of adding unlike fraction. The pupil that understands $\frac{1}{2} + \frac{1}{4}$, will have little difficulty understanding 3/4 - 1/3. (a) A very difficult area that needs considerable attention is the process of subtracting mixed numbers in which the fraction of the number above is smaller than the fraction of the number below. (b) Teach the vocabulary that accompanies this unit.	7. Teach the necessary arithmetic skills to develop an understanding and a skill relating to the process of subtracting unlike fractions and mixed unlike numbers.

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ACTIVITY	TEACHER'S ROLE	REASON
	Suggested film relating to the unit How to Subtract Fraction (Like and Unlike Fractions)	San Diego County
	Suggested filmstrip relating to the unit Subtracting Unlike Fractions and Mixed Numbers (43 Fr.)	School Math Library
8. Multiplying a whole number by a fraction	8. Give examples of this process and have the students give examples. Then as a class develop these concepts. 1. Multiply the numerator of the fraction by the whole number and divide that product by the denominator of the fraction (show that every whole number has a denominator of one) 2. Change the fraction in the result to simplest form. (a) Teach the communitive law for multiplication, that is, $4 \times \frac{1}{2} = \frac{1}{2} \times 4$. (b) As a whole, students have little trouble understanding this arithmetic concept.	8. To teach the basic skill of multiplying a whole number by a fraction
	Suggested film relating to the unit How to Multiply Fractions (10 min.)	San Diego County
	Suggested filmstrip relating to the unit Multiplying Fractions and Mixed Numbers (63 Fr.)	School Math Library
9. Multiplying Whole numbers and a mixed number	9. Teach both basic methods of this process of multiplying a whole number by a mixed number or vise-versa. (a) One way is to multiply the fraction of the mixed number by the whole number. To that product add the product of the integer of the mixed number and the whole number. (b) Or change the mixed number to an improper fraction and then multiply as in the case of fractions. (c) For this student, I feel that the method he uses is not the important item, but that he uses an acceptable method that will increase his own accuracy forgetting about the time element.	9. To develop an understanding and mastery of this arithmetic skill in the student.
10. Multiplying a fraction by a fraction	10. The social applications of multiplying a fraction by a fraction are limited but the computational procedure is rather easy. In any case the correctness of a product can be demonstrated by various aids. It is relatively easy to show that $\frac{1}{2}$ of $\frac{1}{2}$ an item is necessarily $\frac{1}{4}$. (a) After much drill and examples the class should develop this concept. To multipiy two fractions, write the product of the numerators as the numerator of the answer and the product of the denominators as the denominator of the answer. Express the answer in the simplest form.	

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ACTIVITY	TEACHER'S ROLE	REASON
11. Cancellation of fraction	11. Teach cancellation as a form of reducing fractions by <u>dividing</u> any numerator by any denominator evenly.	11. Teach the process of cancellation
12. Multiplying mixed numbers	12. Teach the two basic methods for multiplication of two or more mixed numbers. (a) Change all the mixed numbers to improper fractions, cancel wherever possible and proceed following the methods of multiplication of a fraction by a fraction. (b) Multiply integer times integer and to this product add the product of the fraction and the fraction. Again the method is not the most important item.	12. To teach the arithmetic process of multiplying mixed numbers
	Suggested related films to accompany this unit Careers in the Building Trades (10 min.) How to Investigate Vocations (15 min.)	San Diego County U. of California
13. Thoughts to the teacher before he introduces division of fractions	13. "Division of fractions is the most difficult operation to master in the work with fractions, as it is with whole numbers. When the division is a proper fraction, it often is difficult for the pupil to understand why the quotient is larger than the number divided. Furthermore, occupational surveys have shown that most people seldom divide by fractions in daily life. Hence, much of the work with division of fractions is largely manipulative, and the operation lacks social significance." (2:385)	13. To develop understanding of the process of division of fractions and mastery in such computations.
1. Introduce dividing a whole number by a fraction	14. A pupil often finds it difficult to understand why the answer found in the process is larger than the number divided. Therefore, a great number of visual aids will be necessary. (a) These visual aids should be aids that are familiar to the students such as these examples. 1. A quarter is $\frac{1}{4}$ of a dollar and there are four quarters to a dollar, therefore, one dollar divided by $\frac{1}{4}$ of a dollar is 4. 2. Take an inch measure and ask how many units each $\frac{1}{2}$ of an inch in length are there, $\frac{1}{4}$ of an inch, etc. (b) There has been much discussion as to the proper words to be used for the process of division such as invert, turn upside down, flip it, multiplicative inverse, reciprocal, etc. I feel, with this student, the teacher should permit the student to use the word or words that he is accustomed to using. (c) After much practice, drill, discussion, and concrete social situation, the class should develop the following generalization: To divide a whole	c. To explain the use of a term for inverting the quantity

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ACTIVITY	TEACHER'S ROLE	REASON
	number by a fraction, invert the fraction and change the sign of operation to a multiplication sign and proceed with this operation. Suggested filmstrip relating to the unit Dividing Fractions and Mixed Numbers (44 Fr.)	School Math Library
15. Thoughts to the teacher before the introduction of this unit.	15. A study by Wilson and Dalrymple showed that division of a fraction by a fraction almost never occurs in social situations. Their investigation included over 100,000 fractions and their uses. From the standpoint of social significance, the process of division of a fraction by a fraction could be dropped from the arithmatic curriculum, except as an informational device. (16:341-347)	
6. Dividing a fraction by a fraction	16. The teacher most centainly should not spend time in trying to rationalize this process. This is a pure mechanical operation since the examples have almost no social significance and the inversion process is merely a technique to find the answer. Although the procedure maybe mechanical, its use involves the interpretation and verification of the result. The pupil should be able to tell whether or not the answer is sensible. (a) After examples of this mechanical operation, the class should develop this generalization: to divide a fraction by a fraction, invert the quantity to the <u>right</u> of the sign of operation. Then change the sign of operation to a multiplication sign of operation and then proceed with this operation. (b) If the numbers are kept small and the situations concrete, the students will develop the desired skill in this area.	16. To give information about the arithmetic process of dividing a fraction by a fraction
7. To divide a mixed number by a mixed number	17. When a mixed number is divided by a mixed number, the answer may be a whole number, a fraction, or a mixed number. The procedure is similar to that used in multiplication by mixed numbers, but the divisor must be inverted after it has been changed to an improper fraction. Then the procedure is the same as that followed in dividing by any fraction. Suggested film relating to the unit How to Divide Fractions (10 min.)	17. To teach the basic skill of dividing a mixed number by a mixed number. San Diego County
	Suggested filmstrip relating to the unit Multiplication and Division of Fractions	San Diego County

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ACTIVITY	TEACHER'S ROLE	REASON
18. Find the decimal equivalent of a fraction	18. Much time should be spent in teaching this skill because of the great social implications of this process. (a) Many visual aids would make a reason for teaching this process to each and every student. (b) Use a decimal equivalent chart manufactured by many companies. (c) Explain the system of selecting a drill to drill a hole of precise size. Bring examples of each method borrowed from machine shop. 1. Numbering system 2. Letter system 3. Decimal system 4. Fractional system	18. To teach the process of finding the decimal equivalent of a fraction
	Suggested films relating to the vocational needs	
	How to Operate an Engine Lathe (40 min.)	South Bend Lathe Co.
	The ABC of Internal Combustion Engine (13 min.)	General Motors
	The ABC of Automobile Engines (21 min.)	General Motors
	The ABC of Diesel Engines (20 min.)	General Motors
	The Stylist (30 min.)	Ford Motor Company
	Suggested filmstrips	
	Foundry, Forging, and Heat Treating Occupations	San Diego County
	Other Metalworking Occupations	San Diego County

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ACTIVITY	TEACHER'S ROLE	REASON
1. Introduce decimal fractions	1. You might have the students make up a list of various places decimal fractions might appear such as: (a) Micrometers (b) Thermometers (c) Newspaper financial reports (d) Newspaper sport pages (e) Money	1. To teach the meaning of decimal fractions
2. Teach dividing and multiplying by 10's, 100's, etc.	2. Teach by showing that in order to multiply a decimal fraction by 10's, 100's and 1000's that you may move the decimal point to the right as many places as you have zeros. Since division is the opposite of multiplication you move the decimal point to the left as many places as you have zeros.	2. To teach multiplication and division by 10's
3. Teach writing and reading of decimals	3. There are two kinds of decimals, namely pure decimals, those which have a value less than 1, and mixed decimals, those which have a value greater than 1. Much time can be wasted writing pure and mixed decimals from dictation when the decimal contains four or more places. The class should know that tenths represent one decimal place, hundredths two places, and thousandths three places. When decimal fractions are limited to these units, there may be justification for having the class write them from dictation. Much drill should be spent in learning how to read decimals. (a) Teach the vocabulary that accompanies this unit.	3. To teach the reading and writing of decimal fractions
4. Addition or subtraction of decimals	4. Addition or subtraction of decimals is no more difficult than addition or subtraction of whole numbers. The difference between the operation with decimals and those with integers consists in the interpretation of the result. If the class understands the meaning of decimals, there can be no doubt about correct placement of the decimal point. The transfer from computations with money is made very easily. (a) The most important technique is to teach neatness of work and perfect alignment of the the decimal point, if you want to teach a mechanistic procedure rather than an understanding of decimals. Practice in horizontal addition of decimals would tend to reduce the use of mechanistic procedure. (b) You should teach the following generalizations for addition and a similar list for subtraction. 1. You add decimals just as you add whole numbers. 2. If the decimals are tenths, the sum is tenths or one decimal place; if the decimals are hundredths, the sum is hundredths, or two decimal places. 3. The sum of two or more decimals also may be found by using common fractions.	4. To review addition of decimals
	Suggested filmstrip relating to the unit Fractions, Decimals and Percentages	San Diego County

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ACTIVITY	TEACHER'S ROLE	REASON
5. Multiplication of a whole number by a decimal	5. Teach the communative law of multiplication that 7 x .3 = .3 x 7. Therefore, the example, 7 x .3 is the same as the reverse form except for the method of finding the product. However, there is a true difference which this student does not need to be elaborated on. When a pupil understands that 7 x .3 is 21 tenths because tenths are multiplied by ones, he will readily see that .3 x 7 is 21 tenths. He can see that the product in each case is tenths, expressed with one decimal place. In that way, he can generalize that it makes no difference in the result if the decimal is the number manipulated or the multiplier. He also finds that the product contains the same number of decimal places, if the decimal itself is multiplied, or if the decimal is to be used as the multiplier.	
. Multiplying a decimal by a decimal	6. Teach by giving examples that 3.5 x .5 will have hundreths in the answer because tenths x tenths are equal to hundreths. From many illustrations of this kind the class can develop the concept that: there are as many decimal places in the product as there are in the sum of the number of decimals places in the two numbers multiplied. (a) The pupil often is surprised when he multiplies two decimals to discover that the product is smaller than either of its two factors. You might use this type of example to clarify the problem. . .25 x .25 = .0625 also that $\frac{1}{4} \times \frac{1}{4} = 1/16$, 1/16 = .0625 (b) Teach any vocabulary that would accompany this unit.	6. To teach the arithmetic skill of multiplying a decimal by a decimal (a) To show the social significance of this process
7. Division of decimals	7. Division is again the most difficult process to be performed with decimals just as division is the most difficult process with integers. With this in mind it is suggested that the teacher follow this sequence for teaching division of decimals. 1. A decimal divided by an integer. 2. An integer divided by an integer with a decimal in the quotient. 3. An integer divided by a decimal. 4. A decimal divided by a decimal. (a) Teach the process of rounding off decimal fractions. (b) It has shown in various mathematical surveys that about 15% of all errors in division of decimals resulted from a faulty usage of the zero. The teacher can make the process of changing from fractional to decimal forms meaningful and stress the importance the function of zero as a place holder. (c) Teach the vocabulary that accompanies this unit.	7. To increase the skill in and the understanding of division of decimals

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ACTIVITY	TEACHER'S ROLE	REASON
1. Meaning of percentage	1. Teach the meaning of percentage that it is merely a way of expressing hundredths. Money would be a good example, such as 1 cent is written decimally .01 or 1 part of 100 and as a per cent it is also written .01. (a) Much drill should be provided to the student in the art of changing simple fractions to per cent and per cent to simple fractions. This will give a relationship of fraction, decimal fractions and percentages.	1. To develop a more complete understanding of per cent.
	Suggested films relating to the unit Personal Financial Planning (11 min.) Credits and Loans (17 min.)	 San Diego County San Diego County
2. Finding a per cent of a number	2. Teach the arithmetic meaning of the word <u>of</u> and also the word <u>is</u>. (a) This is a very difficult area of mathematics for the "slow learner" primarily because the vocabulary is relatively new to him. Therefore, the teacher will need to present many everyday experiences to the student. The student is not interested in the purchase of a washing machine, electric range or a home. Rather, he is interested in the purchase of an automobile, surfboard, derailer, or hi-fi equipment. (b) Since this is a country depending on the time payment or credit buying it is of utmost importance that the teacher of "slow learners" teach the units concentrated around time payments because it is this student in particuliar that will find himself buying on credit in his young adult life. (c) A teacher should show the relationship of fraction to percentage problems such as: 20% of $30.00 could be written 1/5 x $30.00 = $6.00 or .20 x $30.00 = $6.00. (d) Teach the vocabulary that accompanies this unit.	
	Suggested film relating to this unit Per Cent in Everyday Life (10 min.)	 U. of California

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ACTIVITY	TEACHER'S ROLE	REASON
1. Teaching the terminology associated with geometric forms	1. Teach this terminology by developing a meaning and understanding about each, by giving illustrations and visual aids. (a) Square (b) Rectangle (c) Parallel lines (d) Triangle 1. Right 2. Equilateral 3. Isosceles (e) Circle (f) Prisms (g) Cube (h) Cylinder (i) Cone (j) Pyramid (k) Diameter (l) Radius (m) Perimeter (n) Circumference (o) Surface Area	1. To set the foundation for this study. To contribute to his general education
2. Teach the area of squares and rectangles	2. Teach that any time we mention a square unit of measure we are talking about the area of a geometric form or the multiplication of two (2) linear measures. (a) Most students have little or no difficulty with the area of squares and rectangles, but do have considerable difficulty with trapezoids. The social significance of the trapezoid is rather remote so it is felt that no time should be spent on this geometric construction. (b) The square and rectangle is so common that the teacher should have little or no difficulty in finding examples common to the student. (For boys the cost of lumber in the woodshop and for girls the cost of material to sew a dress)	2. To teach how to compute the areas of squares and rectangles
3. Teach the comparison of square feet to square yards and other such comparisons.	3. It is very important and much time should be spent in teaching conversion of these units and also the comparison of units. Suggested filmstrip relating to this unit Area of rectangles, Areas of Parallelograms (Part 4)	2. To teach the relationship of square units of measure. San Diego County

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ACTIVITY	TEACHER'S ROLE	REASON
4. Review and teach the area of a triangle	4. Teach by showing that a triangle is half the size of a quadrilateral with the same base. (a) With this background the class can develop the formula for computing the area of any triangle. Suggested filmstrip relating to the unit Areas of Triangles (Part 5)	4. To review and to develop a more concrete understanding of this formula. San Diego County
5. Review and teach the area of a circle	5. Teach the concept of pie or 3.1416 but for these students only 3.14 will be used. (a) Teach that $\pi \times R \times R$ is equal to the area of a circle. (b) Students have little difficulty with this form because of repetition throughout the grades. Suggested filmstrip relating to the unit The Circle (Part 6)	5. To review and develop an understanding of this process San Diego County
6. Perimeters of quadrilaterals and triangles	6. Teach how to find the perimeter of quadrilaterals and triangles. (a) Actually the student should have little difficulty with perimeters of these forms.	6. Review and develop an understanding of perimeters
7. Teach perimeter and circumference	7. Teach that perimeter and circumference mean the same and that the only difference is that perimeter refers to the distance around all forms except circles and that circumference refers only to circles. (a) Develop the idea of pie and its relationship to the circumference. 1. This can be done to show that a cord laid around one circle, if laid out straight, will pass through three such concentric circles with .1416 remainder.	7. Teach the difference between perimeter and circumference
8. Teach the formulas for finding the distance around the geometric forms studied	8. After much discussion the class should develop the formula that would accompany each geometric form studied.	8. Development of the various formulas
9. Teach the difference between area and volume	9. Show that area is an area enclosed by a square each of whose sides is 1 inch, 1 foot, 1 yard, etc. Area only has length and width but volume is a figure that has 3-dimensions (length, width, and depth) and the answer is always in cubic units. Suggested filmstrip relating to the unit Cubic Measure, Volume (Part 7)	8. Clear up any misconceptions about these units. San Diego County

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APPENDIX

ACTIVITY	TEACHER'S ROLE	REASON
10. Teach the volume of a cube	10. The student usually has little difficulty with the volume of a cube. Therefore, it is wise to use this approach to the other geometric solids. (a) The idea that volume is found by multiplying the area of the base times the height or the other linear measure works very well with this type of student.	10. Review and teach the volume of a cube
11. Teach the volume of cylinders	11. Again the approach to this problem should be the concept: area of the base times the height equals volume. (a) In this whole unit involving geometry the teacher will need to call on his ability to provide many visual and touchable aids. The amount of learning and retention of this entire unit will depend on the social significance of this unit to the student.	
	Suggested films relating to this unit Volumes of Cubes, Prisms and Cylinders (18 min.) Volumes of Spheres, Cones and Cylinders (18 min.)	 San Diego County San Diego County

Available Film List

Basic Counting System	
1. The Earliest Numbers $4.00 (30 min.) MP5413	University Extension
2. Origin of Mathematics $1.50 (10 min.) MP2513	University Extension
3. Story of Our Number System (11 min.) MP205	San Diego County
4. Donald in Math Magicland (26 min.)	District Library
5. Understanding Numbers Part I (30 min.)	District Library
Adding and Subtracting Whole Numbers	
1. Adding and Subtracting (10 min.) MP511	San Diego County
Fractions	
1. Introduction of Fractions $3.00 (10 min.) MP3821	University Extension
2. Fractions $4.00 (30 min.) MP5418	University Extension
3. Understanding Numbers Part VI (30 min.)	District Library
How to Add Fractions and Find Equivalents	
1. How to Add Fractions (11 min.) MP511	San Diego County
2. How to Change Fractions (10 min.) MP511	San Diego County
How to Subtract Fractions	
1. How to Subtract Fractions (10 min.) MP511	San Diego County
How to Multiply Fractions	
1. How to Multiply Fractions (10 min.) MP511	San Diego County
How to Divide Fractions	
1. How to Divide Fractions (10 min.) MP511	San Diego County
Per Cent	
1. Per Cent in Everyday Life $3.00 (10 min.) MP5002	University Extension
Volumes of Solids	
1. Volumes of Cubes, Prisms, and Cylinders (18 min.) MP5923	San Diego County
2. Spheres, Cones, and Cylinders (18 min.) MP6042	San Diego County
3. Prisms and Pyramids (18 min.) MP6041	San Diego County
Measurement	
1. Measurement (10 min.) MP511	San Diego County
2. Indirect Measurement $2.00 (12 min.) MP4368	University Extension
3. The Micrometer $2.00 (15 min.) MP5001	University Extension
4. Lines and Angles (10 min.) MP513	San Diego County
5. Parallel Lines (10 min.) MP513	San Diego County
Related or Vocational Films	
1. Career for Girls $2.00 (18 min.) MP4105	University Extension
2. Finding the Right Job $1.50 (12 min.) MP4116	University Extension
3. How to Investigate Vocations $2.00 (10 min.) MP4347	" "
4. Planning Your Career $3.00 (16 min.) MP4580	University Extension
5. Credits and Loans (17 min.) MP6061	San Diego County

6. Personal Financial Planning (11 min.) MP6063	San Diego County
7. Principles of Scale Drawing (10 min.) MP744	San Diego County
8. ABC of Hand Tools (42 min.) MP680	San Diego County
9. Careers in the Building Trades (10 min.) MP690	San Diego County
10. ABC of Internal Combustion (Free) (16 min.)	General Motors
11. ABC of Automobile Engines (Free) (21 min.)	General Motors Corp
12. ABC of Diesel Engines (Free) (20 min.)	General Motors Corp
13. The Stylist (Free)(30 min.)	Ford Motor Company
14. Operating an Engine Lathe	South Bend Lathe Co.
15. Electricity Works for Us (12 min.)	San Diego County

Available Filmstrips

All filmstrips will be ordered through the district office.

Numbering and Counting System	
1. Recognizing Numbers (32 Fr.) FS609	San Diego County
2. Getting Acquainted With Numbers (29 Fr.) FS601	" " "
3. How Many (29 Fr.) FS602	" " "
4. Understand Hundreds, Tens, and Ones (30 Fr.) FS2926	" "
5. Number Stories of 7 and 8 (30 Fr.) FS2922	" " "
6. Number Stories of 9 and 10 (30 Fr.) FS2923	" " "
7. Number Stories of 11 and 12 (30 Fr.) FS2928	" " "
8. Number Stories of 13 to 18 (30 Fr.) FS2929	" " "
Adding Whole Numbers and Subtracting Whole Numbers	
1. Column Addition (30 Fr.) FS2924	San Diego County
2. Adding and Subtracting Two Place Numbers (30 Fr.) FS2927	" " "
3. Subtract to Find Out (30 Fr.) FS2925	" " "
Introduce Fractions	
The Meaning of Fractions (43 Fr.)	School Math Library
Adding Fractions	
Adding Like Fractions and Mixed Numbers (35 Fr.)	School Math Library
Subtraction of Fractions	
1. Subtracting Like Fraction and Mixed Numbers (33 Fr.)	School Math Library
2. Subtracting Unlike Fractions and Mixed Numbers (43 Fr.)	School Math Library
Multiplication of Fractions	
1. Multiplying Fractions and Mixed Numbers (63 Fr.)	School Math Library
Division of Fractions	
1. Dividing Fractions and Mixed Numbers (44 Fr.)	School Math Library
2. Multiplication and Division of Fractions FS511	San Diego County
Review of Fractions	
Fractions, Decimals and Percentage FS511	San Diego County

Geometry

1. Areas
   - A. Area of Rectangules, Parallelograms (Part 4) FS511 — San Diego County
   - B. Area of Triangles, Trapezoids (Part 5 FS511 — San Diego County
   - C. The Circle (Part 6) FS511 — San Diego County
2. Volume
   - A. Cubic Measure: Volume (Part 7) FS511 — San Diego County

Measurement

1. How Long is it? FS389 — San Diego County
2. Linear Measure (Part 1) FS511 — San Diego County
3. Lines, Angles, and Surface Measures (Part 3) FS511 — San Diego County

Vocational or Related

1. Special Measurement (board feet) FS511 — San Diego County
2. Woodworking Trades FS684 — " " "
3. Measuring, Testing and Marking Tools for Woodworking (Set of 8) FS448 — " " "
4. Foundry, Forging, and Heat Treating Occupations FS671 — " " "
5. Other Metalworking Occupations FS671 — " " "
6. The Story of Iron and Steel FS671.52 — " " "
7. Auto Mechanics Occupations FS629.2 — " " "
8. Airplane Mechanics Occupations FS629.1 — " " "

ARITHMETIC FILM DISTRIBUTORS

Bailey Films, 6509 DeLongpre Avenue, Hollywood 28, California

Cornet Films, Cornet Building, Chicago, Illinois

Encyclopedia Britannica Films, Wilmette, Illinois

Knowledge Builders, 625 Madison Ave., New York 22, New York

United World Films, 1445 Park Ave., New York 29, New York

Wayne University, 5272 Second Blvd., Detroit, Michigan

Young America Films, 18 E. 41st Street, New York 17, New York

San Diego County School, Audio-Visual Service, 6401 Linda Vista Road, San Diego 11, California

University Extension, University of California, Department of Visual Instruction, 2441 Bancroft Way, Berkley, California

District Office Film Library, Grossmont Union High School District Grossmont, California

General Motors Corporation, Public Relation Staff, 405 Montgomery St., San Francisco 4, California

Ford Motor Company Film Library, 4303 Telegraph Avenue, Oakland, Calif.

U.S. Department of the Navy, Commandent Eleventh Naval District, Att. Asst. for Public Information, 937 Harbor Drive, San Diego, California

South Bend Lathe Works, South Bend 22, Indiana

W.M.Welch Scientific Company
1515 Sedgwick Street
Chicago 10, Illinois

Quantity	Catalog Number	Description	Price Per Unit	Total Price
2 doz	67	Compass "With clasp for holding lead pencil"	$ 2.50/doz	$ 5.00
2 each	152	Meter Stick, Plastic on one side both edges are graduated in millimeters. On the other side, however, in addition to an inch scale along one edge, there is a metric scale on the other edge.	1.40 each	2.80
2 doz	012	Ruler, Metric and English, Plastic	1.75/doz	3.50
2 doz	225	Protractor, Brass	4.50/doz	9.00
2 each	04396	Chalkboard Compass, Wood "Chalkboard"	1.50 each	3.00
2 each	06279	Protractor "Chalkboard"	3.15 each	6.30
2 each	06278	Triangle "Chalkboard"	2.85 each	5.70
2 each	06276	Straight Edge "Chalkboard"	2.00 each	4.00
1 each	7501	Radian and Circle Demonstrator	7.50 each	7.50
2 each	591	Geometric Solids and Surfaces "23 solids, 18 surfaces, covered storage wood box"	9.25	18.50
1 each	598	Cube and Pyramid "heavy-gauge", Transparent plastic sheet, may be filled with water	5.50	5.50
2 set	3994N	Fraction Series Filmstrips (set of 8) boxed "as listed"	24.00	48.00
included in the set	3994	The Meaning of Fractions (43 Frames)		
	3994A	Changing the Terms of Fractions (48 Frames)		
	3994B	Adding Like Fractions and Mixed Numbers (43 Frames)		
	3994C	Subtracting Like Fractions and Mixed Numbers (33)		
	3994D	Adding Unlike Fractions and Mixed Numbers (33 Frames)		
	3994E	Subtracting Unlike Fractions and Mixed Numbers (43)		
	3994F	Multiplying Fractions and Mixed Numbers (63 Frames)		
	3994G	Dividing Fractions and Mixed Numbers (44 Frames)		

Milton Bradley Company
Springfield 2, Mass

San Diego Office Supply Co.
1035 Seventh Avenue
San Diego, California

2 each	9003	Mathematics Wheel (illustrations of relationships between fractions, common fractions, decimals, percentage values, and angular measurements. Unit is 20" square with directions on the back)	4.00	8.00
2 set	9372	Flash Cards - Add - Subtract (81-6 1/2x3 3/4 card set	1.25	2.50
2 set	9373	Flash Cards - Multiply - Divide 2 problems per card	1.25	2.50
2 set	9501	Flash Cards - Fraction - Percentage 2 prob. per card	1.25	2.50
2 set	9382	Fraction Discs (Each Fraction has its own color and two complete discs	2.25	4.50

Sample Drill
Exercise No. 1

Adding Columns

1. 8
3
4
2
8
+1

2. 7
6
4
1
9
+3

3. 3
9
5
7
6
+4

4. 9
2
6
4
8
+5

5. 16
33
54
+78

6. 54
65
76
+87

7. 38
46
97
+79

8. 65
13
32
89
+57

9. 234
940
+789

10. 708
554
342
+981

11. 43 + 56 =
12. 38 + 74 =
13. 12 + 57 =
14. 41 + 39 =
15. 58 + 43 =
16. 6 + 409 =
17. 81 + 136 =
18. 245 + 8 =
19. 415 + 12 =
20. 60 + 82 + 74 =
21. 75 + 30 + 83 =
22. 63 + 79 + 90 =
23. 73 + 15 + 67 =
24. 47 + 36 + 58 =
25. 73 + 50 + 45 =

Sample Drill
Exercise No. 2

Subtract

1. 147 -68	2. 826 -239	3. 49,062 -23,000	4. 700 -458	5. 69,363 -9,576
6. 97,364 -70,275	7. 20 -18	8. 80 -7	9. 60 -24	10. 40 -6
11. 90 -53	12. 100 -25	13. 100 -72	14. 800 -193	15. 200 -97

16. 95 - 43 =
17. 600 - 508 =
18. 700 - 360 =
19. 400 - 341 =
20. 35 - 18 =
21. 47 - 12 =
22. 58 - 19 =
23. 56 - 43 =
24. 136 - 81 =
25. 41 - 39 =

Sample Drill
Exercise No. 3

Multiplication

1. 9 x 8 =
2. 11 x 11 =
3. 9 x 11 =
4. 9 x 12 =
5. 8 x 12 =
6. 12 x 12 =
7. 8 x 7 =
8. 9 x 6 =
9. 7 x 6 =
10. 100 x 76 =

11. 85 x37	12. 37 x26	13. 49 x22	14. 313 x53	15. 685 x78
16. 68 x70	17. 35 x20	18. 47 x10	19. 85 x90	20. 47 x15

Sample Drill
Exercise No. 4

1. $12\overline{)144}$	2. $25\overline{)625}$	3. $10\overline{)120}$	4. $4\overline{)148}$	5. $986 \div 29$
6. $30 \div 5$	7. $9 \div 9$	8. $6 \div 1$	9. $68 \div 2$	10. $8795 \div 5$
11. $7 \div 0$	12. $87 \div 3$	13. $968 \div 8$	14. $14 \div 5$	15. $65 \div 6$
16. $35 \div 9$	17. $78 \div 4$	18. $74 \div 5$	19. $940 \div 6$	20. $438 \div 3$

Sample Test No. 1

Add

1. 33 + 49

2. 260 + 913

3. 4,787 + 29,177

4. 849 + 98 + 9 + 937

5. 58 + 366 + 3 + 6715

6. 167450 + 32184 + 500863 + 200 + 89157 + 8 + 38524

7. 52 + 39 + 78 + 84 + 47

8. 83 + 609 + 50 + 492 + 586

9. 289 + 6 + 9,970 + 856 + 1,293

10. 7,153 + 4,272 + 4,567 + 1,436 + 8,404

Subtract

11. 147 − 68

12. 95 − 43 = ____

13. 386 − 56 = ____

14. 826 − 239

15. 49,062 − 23,070

16. 700 − 458

17. 69,363 − 9,567

18. 97,364 − 70,275

19. 5,000 − 963

20. 69,008 − 38,850

21. 9 x 8 = ____

22. 22 x 49 = ____

23. 100 x 76 = ____

24. 37 x 26 = ____

25. 37 x 85 = ____

Sample Test No. 2

Perform the following operations

(1) $6\frac{1}{4} + 1\frac{3}{4}$

(2) $2 + 3\frac{1}{4}$

(3) $\frac{1}{2} + \frac{1}{4}$

(4) $2\frac{1}{2} + 1\frac{1}{4}$

(5) $2\frac{3}{4} + 1\frac{1}{2}$

(6) $2\frac{1}{3} + 1\frac{1}{6}$

(7) $\frac{5}{6} + \frac{1}{2}$

(8) $2\frac{1}{2} + 1\frac{1}{3}$

(9) $2\frac{1}{4} + 3\frac{1}{6}$

(10) $\frac{2}{3} + 4\frac{1}{2}$

(11) $\frac{3}{5} - \frac{1}{5}$

(12) $3\frac{1}{4} - 2$

(13) $\frac{3}{4} - \frac{1}{4}$

(14) $6 - 1\frac{1}{2}$

(15) $1\frac{1}{4} - \frac{3}{4}$

(16) $4\frac{1}{3} - 2\frac{2}{3}$

(17) $4\frac{1}{8} - 3\frac{3}{8}$

(18) $4\frac{3}{4} - 2\frac{1}{2}$

(19) $7\frac{1}{6} - 3\frac{7}{8}$

(20) $9\frac{1}{2} - 6\frac{4}{5}$

(21) $1\frac{1}{4} \times \frac{1}{2} =$

(22) $\frac{2}{3} \times 5\frac{2}{5} =$

(23) $2\frac{3}{8} \times 3\frac{1}{3} =$

(24) $\frac{5}{8} \times 6 =$

(25) $\frac{15}{16} \times \frac{3}{8} \times \frac{3}{5} \times \frac{32}{66} \times \frac{30}{48} \times \frac{5}{9} =$

(26) $3\frac{1}{3} \div 2\frac{1}{2} =$

(27) $6 \div 1\frac{1}{2} =$

(28) $\frac{5}{8} \div 5 =$

(29) $\frac{3}{8} \div 3 =$

(30) $9 \div \frac{3}{4} =$

(31) $6\overline{).48}$

(32) $8\overline{)52.4}$

(33) $12\overline{).9}$

(34) $25\overline{)7.75}$

(35) $.16\overline{).912}$

(36) $3.2\overline{).672}$

(37) 2% of \$960

(38) $2\frac{1}{4}$% of \$860

(39) 250% of \$15,558

Sample Test No. 3

Add

1. $\frac{5}{6} + \frac{1}{6}$

2. $4\frac{1}{2} + 2\frac{1}{3}$

3. $3\frac{1}{6} + 2\frac{2}{3}$

4. $\frac{7}{16} + \frac{1}{2}$

5. $5\frac{3}{4} + 3\frac{2}{3}$

Subtract

6. $2\frac{3}{4} + 1\frac{1}{8} + 5\frac{1}{2}$

7. $\frac{13}{16} - \frac{5}{16}$

8. $\frac{7}{8} - \frac{3}{4}$

9. $4 - 2\frac{3}{4}$

10. $16\frac{1}{2} - 5\frac{5}{8}$

11. $\frac{1}{3} \times 15 =$

12. $\frac{5}{8} \times 24 =$

13. $\frac{2}{5} \times 8\frac{1}{3} =$

14. $4\frac{1}{2} \times 6\frac{2}{3} \times \frac{4}{5} =$

15. $\frac{7}{8} \div \frac{7}{8} =$

16. $3\frac{1}{3} \div \frac{1}{3} =$

17. $12 \div \frac{3}{4} =$

18. $\frac{3}{4} \div 2 =$

19. $.6\overline{).072}$

20. $160 \times .375$

21. Sixty is 25 per cent of what number?

22. How much is 85 per cent of 300?

23. What is 2.5 per cent of 340?

24. What per cent of 60 is 42?

25. What is $\frac{1}{4}$ per cent of 1800?

Catalog of Free Teaching Aids

1.	History of Measurement (six poster)	Ford Motor Company - Information Service The American Road. Dearborn, Michigan
2.	The Second R - Safety in Numbers (History of Numbers) (Chart)	The Handwriting Foundation, 1426 G. St., N.W., Washington 5, D.C.
3.	Square Inch, Square Foot, Square Yard (Chart)	John C. Winston Co., 1010 Arch Street, Philadelphia 7, Penn.
4.	Happy Ways to Number (Cards 1 thru 10)	John C. Winston Co., 1010 Arch Street, Philadelphia 7, Penn.
5.	How Long Is A Rod? (Chart)	Ford Motor Co. - Information Service The American Road, Dearborn, Michigan
6.	Notes for teachers (booklet which gives information on many subjects such as meaningful division, grouping, etc.)	World Book Company, 2126 Prairie Avenue, Chicago 16, Illinois
7.	Math Problems from Industry	Chrysler Corp., Ed. Ser., Public Relations Department, P.O. Box 1919, Detroit, Michigan
8.	Solutions to Math Problems from Industry	Chrysler Corp., Ed. Ser., Public Relations Department, P.O. Box 1919, Detroit, Michigan
9.	Should you be an Engineer?	New York Life Insurance Co., 51 Madison Avenue, New York, 10. N.Y.
10.	Figuring Lumber ($8\frac{1}{2}$ x 11 table)	Victor Adding Machine Co., Public Relations Department, 3900 North Rockwell Street, Chicago 11, Illinois.
11.	Decimal Equivalent Chart for Dozens and Fractional Part of a Gross (Chart 8 XII)	Victor Adding Machine Co., Public Relations Department, 3900 North Rockwell Street, Chicago 11, Illinois
12.	Days Expressed In Decimal Equivalents of a year - 365 Day basis (Chart 8 XII)	Same as above
13.	Adventures in Arithmetic (Kit DM-1249): (a) Problems in Mathematical Education (b) Arithmetic Problems: Cause and Solution (c) Arithmetic by Machine Gets Praise	The Burroughs Corp., Education Dept., 6071 Second Avenue, Detroit 32, Michigan.

14.	The Three Why's - No. PRD-53 (Why study Math? Why study science and engineering?	General Electric Co., Education Relations Department, One River Road, Schenectudy 5, New York
15.	World of Numbers	International Business Machine Co., Department of Information 590 Madison Ave., N.Y. 22, N.Y.
16.	How to Read Large Numbers (Chart)	Scott, Foresman and Company San Francisco 5, California
17.	It Makes Solid Sense (Flattened Solids)	Same as above
18.	Illustrated Mathematical Postal Cards Series A,B ($6\frac{1}{2}$ x $9\frac{1}{2}$ portraits of Great Mathematicians)	Scripts Mathematics 186th Street and Amsterdam Ave. New York 33, New York

Possible Textbooks

10-12 Douglass, Kenney, Lentz, Everyday Arithmetic, Holt, 1950.

10-12 Durell, Hagarman, Smith, Arithmetic for Today, Books 6,7,8, Merrill, 1951.

11-12 Hart, Gregory, Schultz, Mathematics in Daily Use, D.C. Heath, 1950.

10-12 Henderson and Pingny, Using Mathematics, McGraw-Hill, 1960.

11-12 Huffman, Twiss, Whale, Arithmetic for Business and Everyday Use, Gregg Publishing Division, McGraw-Hill Book Company, 1956.

12 Landford and Clark, Basic Ideas of Mathematics, World Book Co., 1953.

12 Lankford, Schorling, Mathematics for the Consumer, World Book Co., 1953. Re.

11-12 Lasley and Mudd, The New Applied Mathematics, Prentice Hall, 1948.

11-12 Nelson and Grimes, Making Mathematics Work, Houghton-Miffline, 1955.

10-12 I.I.Nelson, Basic Arithmetic, Book I, Noble and Noble, 1950.

10-12 Osborn and Colestock, Mathematics for Daily Needs, Webster Pub. Co., 1954.

10-12 Piper, Gruber, Curry, Applied Business Arithmetic, South Western, 1959, (paper covers)

10-12 Polishook, Beighley, Wheland, Elements of General Business, Ginn and Co., 1955, revised edition.

10-12 Price, Mullelman, Weeks, General Business for Everyday Living, Gregg Publishing Division, McGraw-Hill, 1960, second edition.

10-12 Rosenberg and Lewis, Essentials of Business Mathematics, 5th edition, revised, Gregg Publishing Division, McGraw-Hill, 1958.

10-12 Carpenter, Anderson, Step by Step in Arithmetic (4) The World of Numbers, Macmillan, 1957.

9-12 Carpenter, McMeen, Anderson, Saver, Ideas in Arithmetic (5) The World of Numbers, Macmillan, 1957.

9-12 Durell, Hagaman, Smith, Arithmetic for Today, Books 4,5,6 (consumable) Merrill Publishing Company, 1951.

9-12 Nelson, Moore, Hamburger, Becker, General Mathematics for the Shop, Houghton Mifflin Company, Boston, 1951.

9-12 Fehr and Schults, Mathematics At Work, D.C.Heath and Co., 1962.

9-12 Lankford, Ulrich, Clark, Essential Mathematics, World Book Co., 1961.

9-11 Potter, Mathematics to Use, Ginn and Co., 1959.

9-12 Reckless, Understanding Arithmetic, Prentice-Hall, 1961.

9-12 Piper, Gardner, Curry, General Mathematics, South-Western Pub. Co.,1954.

9-12 Joseph, Keiffer, Basic General Mathematics, Prentice-Hall, 1958.

9-10 Wiebe, Foundations of Mathematics, Holt, Rinehart and Winston, 1962.

9-10 Betz, Miller, Mitchell, Taylor, Everyday General Mathematics, Ginn Publishing Company, 1960.

9-10 Mallory, Skeen, Mesewe, General Mathematics, L.W.Single Co., 1960.

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2. Brueckner, Leo, and Grossnickle, Foster, Making Arithmetic Meaningful, Pasadena, The John C. Winston Company, c.1953.

3. Carpenter, Dale, and Cuthbertson, Elizabeth, Putting Arithmetic To Work, New York, Macmillan Company, c.1957.

4. Crowhurst, Norman, Basic Mathematics, New York, John F. Rider Publishing Inc., 1961.

5. Cutler, Ann and McShane, Rudolph, (Translators), The Trachtenberg Speed System of Basic Mathematics, Garden City, New York, Doubleday and Company Inc., 1960.

6. Dunn, Lloyd M., "The Slow Learner-An Overview," National Education Association Journal, XXVIII (October, 1959), 19-21.

7. Erdman, Robert L., "The Slow Learner In The Senior High School," National Education Association Journal, XXVIII (October, 1959), 27-28.

8. Fehr, Howard and Schult, Veryl, Mathematics At Work, Boston, D.C. Heath and Company, 1962.

9. _____, Hamilton County Mathematics Guide, Cincinnati, Superintendent of Hamilton County Schools, 1956.

10. Hand, Harold G., Principles of Public Secondary Education, New York, Harcourt, Brace and Company, c.1958.

11. Johnson, James, Applied Mathematics, Milwaukee, The Bruce Publishing Company, c.1939.

12. Kinney, Lucien B., and Purdy, Richard C., Teaching Mathematics In The Secondary School, New York, Rinehart and Co. Inc., c.1952.

13. Nelson, Gilbert; Moore, Frank; Hamburger, Carl; and Becker, Philip, General Mathematics For The Shop, Boston, Houghton Mifflin and Company, c.1951.

14. Porter, Mary, Workbook For Mathematics To Use, Palo Alto, Ginn and Company, c.1959.

15. Stein, Edwin, Refresher Arithmetic, San Francisco, Allyn and Bacon, Inc., c.1957.

16. Wilson, Guy, and Dalrymple, Charles, "Useful Fractions," Journal of Educational Research, 1930.